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Analysis of 1986 Welland Origin-Destination Survey

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INTRODUCTION

Highway 406 in the Welland area is to be constructed in three stages as follows:

1. Woodlawn Road Extension to East Main Street;
2. Southerly from Merritt Road to the Woodlawn Road Extension.
3. East Main Street to Townline Road.

In order to undertake the detail design of Highway 406, Planning and Design Section, Central Region, requested forecasts of the traffic that would be diverted from Niagara Street and East Main Street in Welland as a result of the three stages of construction of Highway 406.

To ascertain the potential divertible traffic to the Woodlawn Road Extension and Highway 406 south to Main Street, and subsequent stages of construction, an origin-destination survey was undertaken for the Transportation Demand Research Office by the Traffic Management and Engineering Office field staff at four locations in the Welland Area, in May and June 1986, to identify existing trip patterns.

This report documents the objective of the study, the details of the origin-destination survey, the data processing and analysis undertaken relative to the origin-destination data collected and the percentage of the traffic to be diverted from Niagara Street and East Main Street in Welland as a result of the staged construction of Highway 406.

OBJECTIVES

The objective of this study is to determine the percentage of 1986 observed traffic that will be diverted to the Highway 406 bypass for each of the stages of construction. Both twelve hour and peak period volumes are included in the analysis.

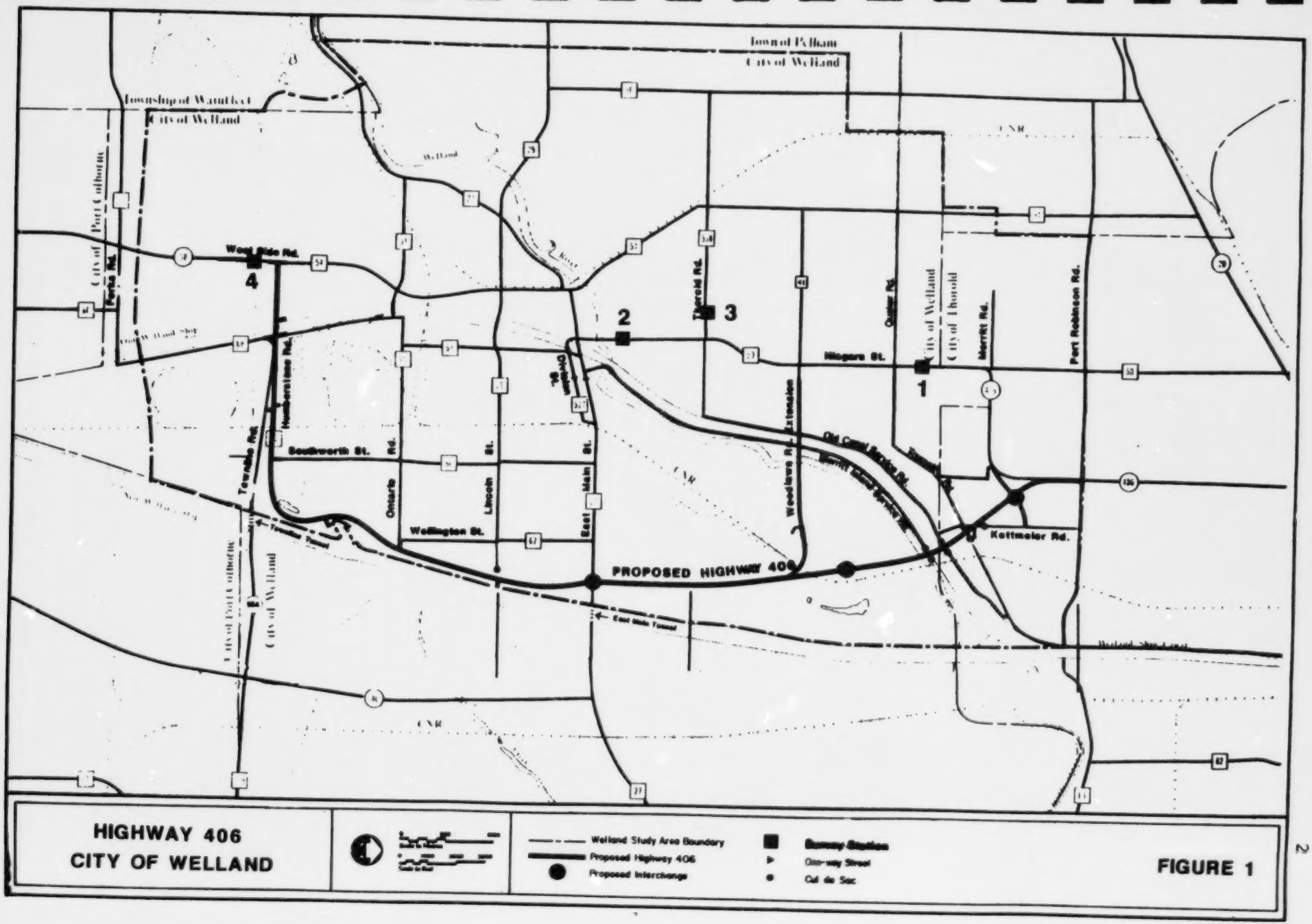
STUDY DESIGN

The origin/destination survey took place in spring 1986. Four survey stations were included. The locations were;

1. Highway 58 north of Quaker Road (southbound only)
2. Thorold Road west of Niagara Street (eastbound only)
3. Niagara Street at Church Street (northbound only)
4. Highway 58 north of Kleiner Street (northbound only)

The station locations are shown in Figure One.

At stations one and four, roadside interviews were used to collect the data; stations two and three were mail-back surveys. A copy of the roadside forms can be found in Appendices One and Two. Appendices Three and Four offer



HIGHWAY 406
CITY OF WELLAND

FIGURE 1

samples of the mailback survey forms for stations two and three respectively. The roadside interviews were conducted on May 8 and 9; the mail-back forms were handed out on June 23. The data were collected for a twelve hour period, from 7:00 am to 7:00 pm.

Several factors regarding the data set must be kept in mind when considering the volumes presented in this report. First of all, the data were collected for only twelve hours and thus do not represent daily traffic counts. Secondly, the data are one-way counts. No data were collected for traffic in the opposite direction. The use of fixed survey station locations results in traffic not being included in the study. Any vehicle that did not pass a station on the dates of the survey was not counted and is not included in the volumes listed here. The volumes shown on the links are present observed data; no growth factors have been applied to the counts to determine future volumes.

All of the data attributes listed above result in lower volumes being assigned than will actually exist on the network. Some double-counting of trips may have occurred, increasing the counts, but this does not offset all of the volume reducing factors. Thus, the volumes are lower than the volumes that will exist on the links in the future. For this reason, emphasis is placed on the percentage of traffic diverted rather than the actual number of vehicles diverted. This then offers some idea as to the impact of the bypass upon congestion in the core area.

DATA PROCESSING

As a means of facilitating the analysis of the data, the information contained on the survey forms was coded for entry into computer data files. This work, the coding and data entry, was carried out by Ian Fisher. All other work outlined in this report was carried out by TDRO.

The final data set contains 4764 records. These were separated by station and vehicle type, car or truck. Column one of Table One provides a list of the number of data records by station and vehicle type. For present use, all of the records were combined in order to consider all trips in the determination of link volumes. As the data were coded directly from the survey forms, Appendices One, Two and Three provide a list of the data contained in the survey records.

In order to determine the error rate within the data set, a ten percent check was undertaken. That is, for every tenth record each data field was compared to the data listed on the survey record form. The origin and destination codes were verified by determining the codes for the addresses on the original survey forms and comparing these to the zones listed in the data records. This involved an examination of 489 records. Of these, 27 records contained at least one error, a 5.5 percentage. The majority of the errors were incorrect

origin or destination zone coding . Although the error rate is quite high, the fact that most of the errors were incorrect zone coding causes many of them to be masked by the zone conversion process. This is discussed in more detail later in this section. Table One lists the number of records checked and errors by station number and vehicle type.

Since time did not permit the checking of data fields for all records, a range check was performed on all the data so as to identify the values which were not within the prescribed limits for each particular variable. The out of range values were corrected; 35 of these were identified.

During the data collection a count of the number of vehicles passing each station each hour was kept. These data, along with the knowledge of the number of surveys completed in each hour, allowed for the calculation of trip factors. This is the ratio between the number of observed vehicles passing the station in an hour to the number of completed surveys in the same time period. The factors were calculated for each vehicle type by hour by station; they were then added to the data records. Factoring the records by the trip factors expanded the data set to 21844 trips.

The origin and destination of each trip was initially coded to the PTZ zone system with a further breakdown into 51 internal Welland zones. Since the prime concern here is traffic movement within Welland, a zone conversion was performed in order to reduce the number of external zones. The new system contains 72 zones. The 51 internal Welland zones were not altered; the external zones were aggregated in order to reduce the complexity of the analysis.

As stated earlier, the data check identified a number of origin and destination zone coding errors. However, approximately one half of these involved external zones. After zone conversion these errors were removed. For example, the zone conversion reduced the number of zones in St. Catharines from 21 to one. Thus, incorrect coding of internal St. Catharines zones is not significant. As a result, the error percentage fell to 2.7.

At this stage the data processing was complete. The data had been checked, the trip factors added to the records and a zone conversion performed. Trip tables were then built as the first step of the analysis.

ANALYSIS

As the first step in the analysis phase of the study, trip tables were created based upon the 72 zone system. The trip factors were applied to the data, thus the origin/destination pairs are the survey trips factored up to the number of observed trips. Three trip tables were created: morning peak period (7:00-9:00 am), afternoon peak period (4:00-6:00 pm) and twelve hour volume. This resulted in three 72 x 72 matricies containing the number of trips between all zones.

Table One Data Check Summary

	Number of Records	Records Checked	Number of Errors	Percent Error
Station 1 -- Cars	1737	179	11	6.1
-- Trucks	71	8	1	12.5
Station 2 -- Car	1327	132	5	3.2
-- Trucks	198	20	1	5.0
Station 3 -- Cars	427	43	3	7.0
-- Trucks	63	7	2	28.6
Station 4 -- Cars	861	91	4	4.4
-- Trucks	80	9	0	0
Total	4764	489	27	5.5

Niagara Region supplied T.D.R.O. with a future Welland road network file. This network included the Woodlawn Road extension and the completed -- three stages -- Highway 406 bypass. This is the network upon which the trips were assigned.

In order to assess the impact of the bypass on traffic volumes, the network file was altered to reflect the staged construction. In all, four network files were used. The network, as received from Niagara, served as the input for the stage three assignment. The Highway 406 links and the Woodlawn Road extension were removed to create a network without the bypass. Through similar editing, network files for stages one and two were built. Then, using these four networks and the three trip matricies, assignments were run to determine volumes for the different stages. The following sub-sections present the results of the assignment for selected links for the twelve hour volumes, the AM peak period and the PM peak period on the four networks. The streets are shown in Figure One.

No detailed discussion of volumes is offered here; the percentage of traffic diverted is listed in tabular form. Those links with no assigned volumes for the "without 406" stage are not included in the tables.

Twelve Hour Volumes

The volumes discussed in this section represent all trips in the data file; all car and truck records for the four stations have been factored and merged to determine the 12 hour observed volumes.

Table Two gives a list of the percentage of traffic -- based upon the volumes without the 406 bypass -- diverted from the existing streets for each of the stages of construction. That is, the percent listed for each street section is the percentage of the without 406 volume that has been removed from that particular link for that stage of the bypass.

The construction of stage one has little effect on the volumes on Niagara Street north of Woodlawn Road. Traffic increases slightly on these links but essentially remains unaltered. Niagara Street between Woodlawn Road and East Main Street experiences a substantial reduction of traffic. This is especially true in the northbound direction. East Main Street, except for the link connected to the bypass, also has reduced volumes. Traffic on Woodlawn Road increases.

The volumes on Niagara Street, Division Street and East Main Street decline further with construction of stage two. Only the link of East Main Street which provides access to the bypass has increased traffic. Volumes on Woodlawn Road fall below the stage one levels. This suggests that fewer vehicles are using Woodlawn Road to gain access to the bypass; these vehicles are entering the bypass further to the north.

Table Two Percentage of Twelve Hour Volumes Diverted From Existing Links

Street	Section	Percentage Diverted Stage 1	Stage 2	Stage 3
Niagara Street				
	Woodlawn Rd. to East Main St.			
	N.B.	25-35	35-45	40-50
	S.B.	10-20	20-35	20-40
Division Street				
	E.B.	15-35	30-45	35-45
East Main Street				
	Crowland Ave. to Niagara St.			
	W.B.	20-40	35-50	35-50
Woodlawn Road				
	East of Extension			
	E.B.	15	30	30

Table Three Percentage of AM Peak Period Volumes Diverted From Existing Links

Street	Section	Percentage Diverted Stage 1	Stage 2	Stage 3
Niagara Street				
	Merritt Rd. to Woodlawn Rd.			
	N.B.	0	30-45	45-60
	S.B.	0	10-25	15-30
	Woodlawn Rd. to East Main St.			
	N.B.	25-30	40-50	50-60
	S.B.	10-20	15-30	20-35
Division Street				
	E.B.	15-35	30-60	35-60
East Main Street				
	Crowland Ave. to Niagara St.			
	W.B.	30-45	50-60	50-60

Table Four Percentage of PM Peak Period Volumes Diverted From Existing Links

Street	Section	Percentage Diverted Stage 1	Stage 2	Stage 3
Niagara Street				
	Merritt Rd. to Woodlawn Rd.			
	N.B.	0	20-55	25-60
	S.B.	0	10-25	15-30
	Woodlawn Rd. to East Main St.			
	N.B.	20-25	35-45	40-50
	S.B.	5-20	20-40	20-40
Division Street				
	E.B.	15-40	25-35	25-40
East Main Street				
	Crowland Ave. to Niagara St.			
	W.B.	15-30	30-45	30-45
Woodlawn Road				
	East of Extension			
	E.B.	5-10	30-35	30-35

With the completion of stage three, volumes on Niagara Street decrease further. The east/west streets (Woodlawn, Division and East Main) do not experience significant changes from the stage two situation. The volumes on East Main Street are lower than those for stage two as more traffic makes use of the new section of the bypass.

Morning/Evening Peak Period

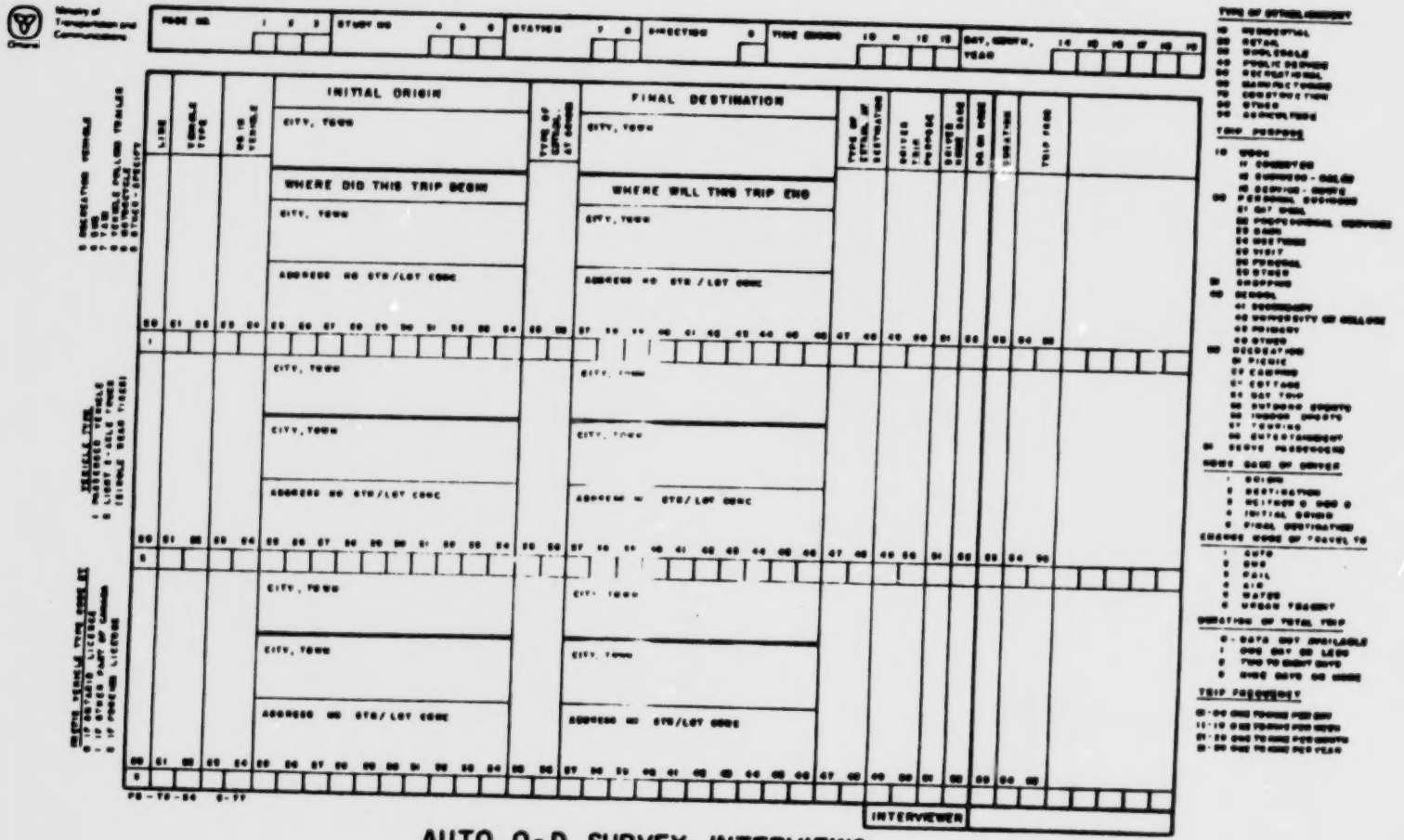
The volumes presented here represent the observed trips between 7-9 am for the morning peak period and 4-6 pm for the evening peak period.

The effects of the construction of Highway 406 upon peak period traffic in Welland are essentially the same as those for the twelve hour period. Therefore, they are not detailed here; the general effects can be found in the previous section. The percentages of diverted traffic for the AM and PM peak periods are listed in Tables Three and Four respectively.

CONCLUSION

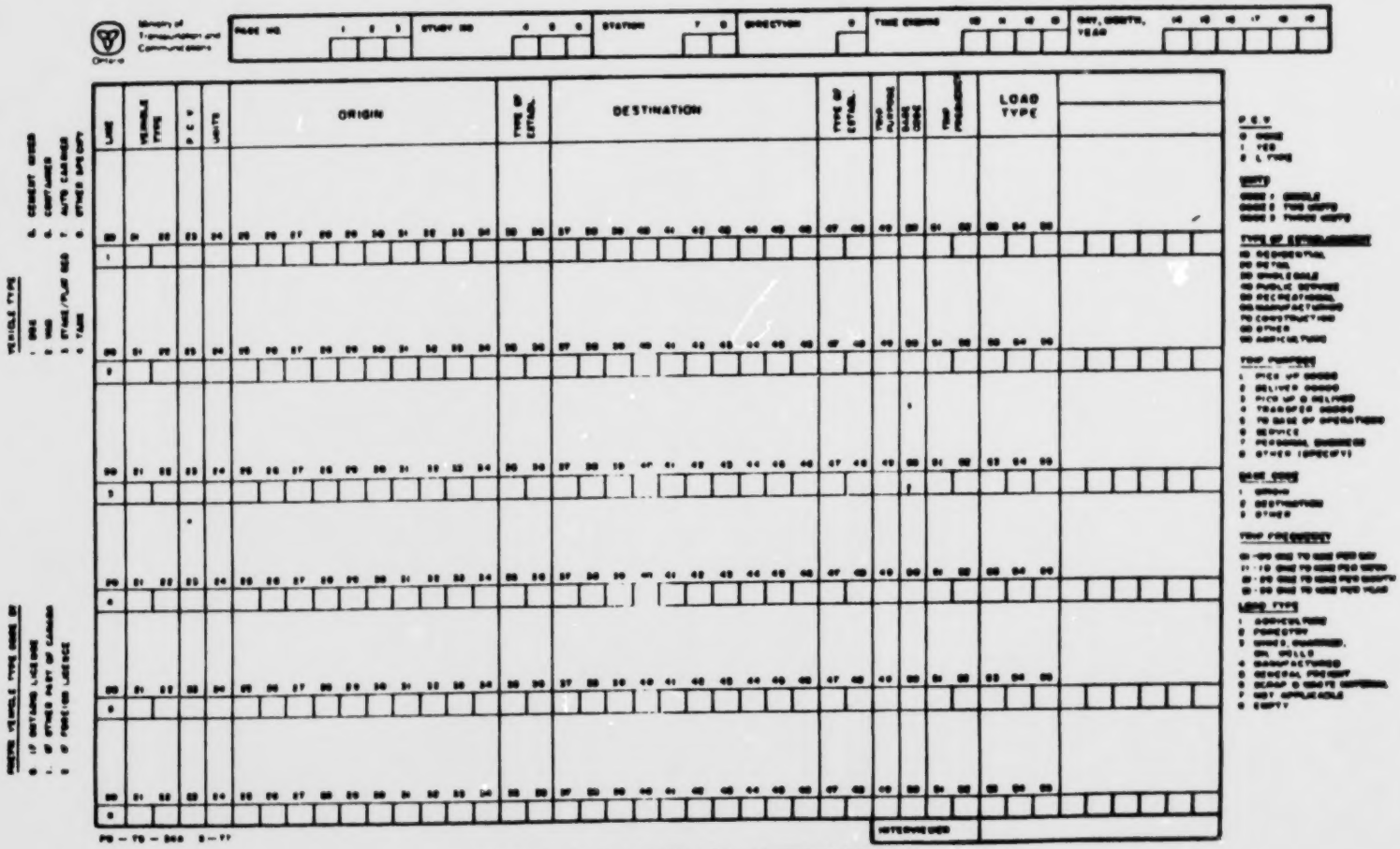
Given the data limitations outlined earlier -- especially the fact that the counts represent one way twelve hour volumes --, little can be said here regarding future volumes on the Highway 406 bypass of Welland and the Woodlawn Road extension. However, the data do offer some insights into the possible effect of the bypass upon congestion in the core area. Essentially, Highway 406 will substantially reduce traffic on Niagara Street and the downtown section of East Main Street. Traffic volumes will increase along Woodlawn Road and the section of East Main Street connected to the bypass. Congestion in the core should be reduced as approximately 30-40 percent of the traffic will be diverted with the completion of the bypass.

In order to assess the total effectsof the construction of Highway 406 in the Welland area, further data collection is required. The volumes upon selected streets should be monitored for each stage of construction so as to identify the actual effect of the bypass in terms of congestion reduction in the core area and as a means of determining the actual volumes along the links of the bypass.



AUTO O-D SURVEY INTERVIEWS

INTERVIEW AND CODING FORM FOR AUTOS



TRUCK O-D SURVEY INTERVIEWS

INTERVIEW AND CODING FORM FOR TRUCKS

Ministry of Transportation & Communications
Ontario

APPENDIX 3

June 24, 1986

Dear Sir or Madam:

The Ministry of Transportation and Communications is conducting a traffic survey to establish travel characteristics on the roads in Thorold, Welland and Port Colborne. This is a routine traffic survey used for monitoring changing traffic conditions. We request your co-operation in providing information which is essential for planning improved transportation services.

Your assistance, by completing the following questionnaire and returning it as soon as possible in the envelope provided, will be greatly appreciated. No postage is required.

YOUR ANSWERS WILL BE TREATED IN THE STRICTEST CONFIDENCE. YOU NEED NOT ANSWER ALL QUESTIONS IF YOU DO NOT WISH TO. PLEASE RETURN THE QUESTIONNAIRE.

Thank you for your assistance and co-operation.

Yours truly,

G.H. JOHNSTON
Assistant Deputy Minister
Provincial/Municipal Transportation

As you were driving eastbound on Thorold Road west of Niagara St. today, this questionnaire was handed to you by the Ministry's Traffic Survey Staff. Please answer the following questions regarding your trip and return the questionnaire in the envelope provided.

1. Please check (✓) the type of vehicle you were driving:
   a car___, or a truck___

2. Please check (✓) the time of day you were driving at the above location.
   7- 8 am___ 8-9 am___ 9-10 am___ 10-11 am___
   11-12 am___ 12-1 pm___ 1- 2 pm___ 2 - 3 pm___
   3- 4 pm___ 4-5 pm___ 5- 6 pm___ 6 - 7 pm___

3. Where did your trip begin?

   _____
   Address (or nearest road intersection) Town

4. Where did your trip end?

   _____
   Address (or nearest road intersection) Town

5. What was the purpose of the trip?
   (To be answered by car drivers only)
   (a) Home to work___ (b) Work to home___
   (c) Business___ (d) Shopping ___
   (e) Recreational___ (f) Personal ___
   (g) Other___

6. How many people, including the driver, were in your vehicle? ___

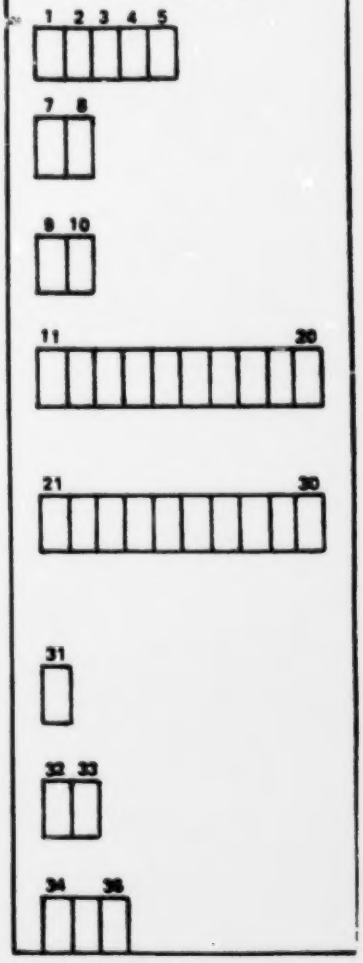
7. How often do you make this same trip?
   ___ times per week, or ___ times per month, or ☐ less than once per month.

8. Comments: _____

   _____

   _____

MTC USE ONLY



Ontario Transportation and Communications

APPENDIX 4

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YOUR ANSWERS WILL BE TREATED IN THE STRICTEST CONFIDENCE. YOU NEED NOT ANSWER ALL QUESTIONS IF YOU DO NOT WISH TO. PLEASE RETURN THE QUESTIONNAIRE.

Thank you for your assistance and co-operation.

Yours truly,

G.H. JOHNSTON
Assistant Deputy Minister
Provincial/Municipal Transportation

As you were driving northbound on Niagara St. near Church St. today, this questionnaire was handed to you by the Ministry's Traffic Survey Staff. Please answer the following questions regarding your trip and return the questionnaire in the envelope provided.

1. Please check (✓) the type of vehicle you were driving:
   a car___, or a truck___

2. Please check (✓) the time of day you were driving at the above location.
   7- 8 am___ 8-9 am___ 9-10 am___ 10-11 am___
   11-12 am___ 12-1 pm___ 1- 2 pm___ 2 - 3 pm___
   3- 4 pm___ 4-5 pm___ 5- 6 pm___ 6 - 7 pm___

3. Where did your trip begin?
   _____
   Address (or nearest road intersection) Town

4. Where did your trip end?
   _____
   Address (or nearest road intersection) Town

5. What was the purpose of the trip?
   (To be answered by car drivers only)
   (a) Home to work___ (b) Work to home___
   (c) Business___ (d) Shopping___
   (e) Recreational___ (f) Personal___
   (g) Other___

6. How many people, including the driver, were in your vehicle? ___

7. How often do you make this same trip?
   ___ times per week, or ___ times per month, or ☐ less than once per month.

8. Comments: _____
   _____
   _____

MTC USE ONLY